

Claims

- [c1] 1.A filtering apparatus for removing contaminants from a fluid comprising:
a first conduit for coupling with a fluid container;
a second conduit for coupling with said fluid container;
a pump disposed between said first conduit and said second conduit for
pumping fluid through said first conduit, said second conduit, and said fluid
container;
a filter disposed between said first conduit and said second conduit for filtering
contaminants from said fluid being pumped through said first conduit and said
second conduit;
a compressed fluid-driven flow-reversing means for reversing a flow direction
through said first conduit, said second conduit, and said fluid container.
- [c2] 2.An apparatus of Claim 1 wherein said flow-reversing means is further for
reversing flow of fluid through said first conduit while maintaining a constant
direction of flow of fluid through said pump and said filter.
- [c3] 3.An apparatus of Claim 2 wherein said flow-reversing means includes a dual-
alternating output valve.
- [c4] 4.An apparatus of Claim 3 wherein said flow-reversing means is disposed
between said pump and said fluid container and further disposed across said
first conduit and said second conduit.
- [c5] 5.An apparatus of Claim 3 wherein said dual-alternating output valve is
pneumatically driven.
- [c6] 6.An apparatus of Claim 5 wherein said dual-alternating output valve comprises
a cylindrical piston.
- [c7] 7.An apparatus of Claim 6 further comprising a means for injecting bursts of air
into said first conduit, wherein said bursts of air are less than one-tenth (1/10)
of one second in duration.
- [c8] 8.An apparatus of Claim 1 wherein said flow-reversing means further includes
an automated switching means for reversing said flow direction after an interval

of less than one (1) second.

- [c9] 9. An apparatus of Claim 8 wherein:
 said automated switching means comprises a programmable logic controller which is configured to cause said flow direction to reciprocate with a cycle of a flow in one direction for a plurality of seconds, followed by said interval of less than one (1) second in an opposite direction;
 said fluid is engine oil; and,
 said first conduit and said second conduit are hoses.
- [c10] 10. An apparatus of Claim 8 wherein:
 said plurality of seconds is less than ten (10) seconds; and,
 said fluid is transmission fluid.
- [c11] 11. An apparatus of Claim 8 wherein said programmable logic controller is coupled to and provides control signals to a source of compressed air for pneumatically driving said dual-alternating output valve of said flow-reversing means; and wherein said fluid is a refrigerant used in an air-conditioning system.
- [c12] 12. An apparatus of Claim 11 wherein said bursts of air are repeated at least five (5) times per minute.
- [c13] 13. A flushing apparatus for removing contaminants from a fluid comprising:
 a first conduit for coupling with a fluid container;
 a second conduit for coupling with said fluid container;
 a pump disposed between said first conduit and said second conduit for pumping fluid through said first conduit, said second conduit, and said fluid container;
 a heater disposed between said first conduit and said second conduit for heating fluid being pumped through said first conduit and said second conduit;
 a filter disposed between said first conduit and said second conduit for filtering contaminants from said fluid being pumped through said first conduit and said second conduit;
 a fluid aerator disposed between said first conduit and said second conduit for

providing a controlled injection of bursts of gases into said fluid at a rate of at least five (5) bursts per minute where each burst is less than one (1) second in duration.

[c14] 14.An apparatus of Claim 13 wherein said fluid is fluid used to cool a portion of an automobile.

[c15] 15.An apparatus of Claim 14 further comprising a dual-alternating output valve for reversing a flow direction of said fluid.

[c16] 16.An apparatus of Claim 15 wherein said fluid aerator is coupled to and under the control of an automated air-injection control means.

[c17] 17.An apparatus of Claim 16 wherein:
said automated air-injection control means further is configured to manipulate a source of compressed air for driving said dual-alternating output valve; and,
said portion of an automobile is a transmission.

[c18] 18.A method of cleaning contaminants from a fluid container comprising the steps of:
circulating, in a first direction, fluid in said container through a first conduit, a pump, and a second conduit and a filter;
stopping a flow of fluid through said first conduit without changing a flow direction of fluid through said filter;
resuming said flow in said first direction after a time interval; and
where said time interval is less than ten (10) seconds in length.

[c19] 19.A method of Claim 18 wherein said interval is less than one (1) second in duration.

[c20] 20.A method of Claim 19 wherein said interval is less than one-half ($\frac{1}{2}$) of a second in duration.

[c21] 21.A method of removing contaminants from a container in a vehicle, said method comprising the steps of:
determining a flow direction of a first fluid through a container on a vehicle,
which container is configured to facilitate heat transfer from the first fluid to a

second fluid;

where said container has an inlet end and an outlet end and during operation of the vehicle, the first fluid flows only in one direction, which is from the inlet end to the outlet end;

coupling a filter system to the inlet end of the container;

pumping the first fluid in a primary cleaning flow direction from the outlet end toward the inlet end, so that contaminants disposed in said container at a location nearer the inlet end than the outlet end are expelled from the container without traveling a distance within the container which is longer than one-half of a total travel distance of the first fluid flowing from said inlet end to said outlet end;

reversing a flow of said first fluid through said container;

resuming flow of the first fluid in said primary cleaning flow direction at a time within a predetermined reversal interval from when said step of reversing a flow is commenced;

wherein said predetermined reversal interval is less than 10 seconds; and,

repeating said steps of reversing and resuming such that said first fluid flows in a reverse direction for a cumulative reverse direction duration for no more than ten percent of a cumulative primary cleaning direction duration of first fluid flowing in said primary cleaning direction.

[c22] 22.A method of claim 21 wherein said predetermined reversal interval is less than one-fourth of one second; and,
said step of reversing a flow is accomplished with a compressed fluid driven valve.

[c23] 23.A method of claim 22 wherein said compressed fluid driven valve is driven by compressed air.

[c24] 24.A method of claim 21 wherein said first fluid is an air-conditioning refrigerant, and said second fluid is air.

[c25] 25.A method of claim 21 wherein said first fluid is transmission fluid;
said second fluid is engine coolant; and,
said container is a transmission fluid cooler.

[c26]

26.A filtering apparatus for removing contaminants from transmission fluid comprising:

- a first conduit for coupling with a transmission fluid container;
- a second conduit for coupling with said transmission fluid container;
- said transmission fluid container comprising a transmission fluid cooler which is configured to facilitate heat transfer from a transmission fluid to an engine coolant when the transmission fluid flows in a first direction through the transmission fluid cooler;
- where the first direction is a direction of flow of the transmission fluid during operation of a vehicle;
- a pump disposed between said first conduit and said second conduit for pumping transmission fluid through said first conduit, said second conduit, and said transmission fluid container;
- a filter assembly disposed between said first conduit and said second conduit for filtering contaminants from said transmission fluid being pumped through said first conduit and said second conduit;
- said filter assembly including a first stage filter, a second stage filter and an airborne fluid exhaust port;
- a flow-reversing means for reversing a flow direction through said first conduit, said second conduit, and said fluid container, which is driven by compressed air;
- wherein said flow-reversing means is further for reversing flow of fluid through said first conduit while maintaining a constant direction of flow of fluid through said pump and said filter;
- wherein said flow-reversing means includes a dual-alternating output valve;
- wherein said flow-reversing means is disposed between said pump and said fluid container and further disposed across said first conduit and said second conduit;
- wherein said dual-alternating output valve comprises a pneumatically driven cylindrical piston with a first port flow region having a smaller diameter than a central full-width sealing region; said cylindrical piston further having a second port flow region having a smaller diameter than said central full-width sealing region;

wherein said cylindrical piston is pneumatically driven between alternating positions where transmission fluid is permitted to flow from only one output port of said dual-alternating output valve;

means for injecting bursts of air into said first conduit and said second conduit, wherein said bursts of air are less than a one (1) second duration;

wherein said flow-reversing means further includes an automated switching means for reversing said flow direction after an interval of less than one-half (1/2) of a second;

wherein said automated switching means is a programmable logic controller and said flow direction reciprocates with a cycle of a flow in a second direction of a plurality of seconds followed by said interval of less than one-half (1/2) of a second in said first direction, wherein said second direction is opposite said first direction; and

wherein said first conduit and said second conduit are hoses.